3GPP TSG RAN meeting #71 RP-160548~~0302~~
Göteborg, Sweden, March 7 - 10, 2016

Source:	**Huawei**
Title:	**Work item proposal: Further Enhancement of Base Station (BS) RF and EMC requirements for Active Antenna System (AAS)**
Document for:	**Approval**
Agenda Item:	**10.1.4**

3GPP™ Work Item Description

For guidance, see 3GPP Working Procedures, article 39; and 3GPP TR 21.900.
Comprehensive instructions can be found at http://www.3gpp.org/Work-Items

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Title: Further Enhancement of Base Station (BS) RF and EMC requirements for Active Antenna System (AAS) core part

Acronym: Enh_AAS_BS_LTE_UTRA_core

Unique identifier:

NOTE: If this is a RAN WID including Core and Perf. part, then Title, Acronym and Unique identifier refer to the feature WI. Please tick (X) the applicable box(es) in the table below:

This WID includes a Core part	x
This WID includes a Performance part	x

1 3GPP Work Area

x	**Radio Access**
	Core Network
	Services

2 Classification of WI and linked work items

2.0 Primary classification

This work item is a …

	Study Item (go to 2.1)
x	**Feature (go to 2.2)**
	Building Block (go to 2.3)
	Work Task (go to 2.4)

NOTE: Core, Performance and Testing parts of RAN WIs are usually Building Blocks.
If you are in doubt, please contact MCC.

2.1 Study Item

Related Work Item(s) (if any]		
Unique ID	**Title**	**Nature of relationship**

Go to §3.

2.2 Feature

Related Study Item or Feature (if any)		
Unique ID	**Title**	**Nature of relationship**

Go to §3.

2.3 Building Block

Parent Feature (or Study Item)		
Unique ID	**Title**	**TS**

This work item is …

	Stage 1 (go to 2.3.1)
	Stage 2 (go to 2.3.2)
	Stage 3 (go to 2.3.3)
	Test spec (go to 2.3.4)
	Other (go to 2.3.5)

2.3.1 Stage 1

Source of external requirements (if any)		
Organization	**Document**	**Remarks**

Go to §3.

2.3.2 Stage 2

Corresponding stage 1 work item		
Unique ID	**Title**	**TS**

Other source of stage 1 information		
TS or CR(s)	**Clause**	**Remarks**

If no identified source of stage 1 information, justify:

Go to §3.

2.3.3 Stage 3

Corresponding stage 2 work item (if any)		
Unique ID	**Title**	**TS**

Else, corresponding stage 1 work item		
Unique ID	**Title**	**TS**

Other justification		
TS or CR(s) or external document	**Clause**	**Remarks**

If no identified source of stage 2 information, justify:

Go to §3.

2.3.4 Test spec

Related Work Item(s)		
Unique ID	**Title**	**TS**

Go to §3.

2.3.5 Other

Related Work Item(s)			
Unique ID	**Title**	**Nature of relationship**	**TS / TR**

Go to §3.

2.4 Work task

Parent Building Block		
Unique ID	**Title**	**TS**

3 Justification

The core part of R13 AAS WI has been completed for RAN#71. The conformance part is due to be completed by RAN#72. The rel-13 AAS BS is distinguishable from the non-AAS BS by a number of key points:

- OTA requirements for EIRP and EIS capture system (including RDN and antenna array) performance.
- For a number of conducted requirements (conducted emissions and power) the AAS BS requirements capture multiple transceiver units as a group (as opposed to a single transceiver or antenna connector)

- An increasing number of transceiver units (where number of transceiver units may be greater than the number of RAN1 ports
- The antenna is included as part of the architecture

The R13 AAS BS specification contains a full set of conducted requirements at the transceiver array boundary and has introduced 2 radiated requirements. While conducted requirements offer a convenient way to implement comparable requirements to the non-AAS specification on the AAS architecture, it has been recognized in the course of R13 AAS WI that radiated requirements are needed to ensure basic functionality of beam forming, and spatial accuracy.

- EIRP accuracy requirements ensure controlled phase relationships between transmitter units.
- EIRP extreme steering directions ensure energy (beams) can be directed as declared by manufacturer.
- OTA sensitivity ensures coherent combining of receive branches has been obtained as declared.
- Declaration of EIRP and OTA sensitivity ensures, scan loss, coupling, self interference and radiation efficiency are included in the requirement.

With the increase in the number of antenna ports that will be supported in future FD-MIMO evolution and given the fact that AAS BS is considered more suitable for implementing such features as well as its many other benefits such as dynamic cell splitting and beam-forming, it is necessary to continue to enhance the AAS specifications in R14.

Moreover, as the number of transceiver units and transceiver array boundary connectors increases, the restriction of having a conducted interface becomes infeasible to both implementation and to testing. Also, the increased integration of such systems will result in increased interaction between transceiver units both in the transceiver unit array and in the RDN/Antenna array. Capturing these effects (such as intra IMD) is difficult when applying requirements to a conducted connector at a time. Since radiated testing, which is by nature testing the whole system, would simplify capturing interactions between units, it would be useful to have an all radiated set of requirements suitable for Over-The-Air (OTA) testing as:

- For practical reasons, it removes the need for dedicated conducted interfaces and reduces the amount of testing.
- It ensures all effects of complex systems are captured making a more robust requirement.

Therefore, it is desirable to enhance the R13 AAS specification mainly from two perspectives:

1. Develop all OTA requirements and the associated testing
2. R13 specification is the first version and there needs to be improvement in terms of readability

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4 Objective

The enhanced rel-14 AAS BS specification will be based on migrating the existing R13 AAS BS conducted requirements to over the air requirements which provide the same level of performance and protection as the rel-13 AAS BS requirements do.

It is composed of the following work tasks:

a) Core RF requirements

b) Conformance testing requirements, derived from the core RF requirements, and demodulation testing requirements.

Due to the necessary study required to arrive at requirement that does not require excessive measurement and will be practical (i.e. easy to measure) and robust, it is decided to include a study phase to identify the OTA core and conformance concepts before writing the specification text

4.1 Objective of Core part WI

This is the core work item to specify the BS core RF radiated requirements for AAS.

The work can be split into 3 major issues:

1. In band requirements where the antenna element pattern is known, but correlation levels are unknown.
    - In DL requirements operating band unwanted emissions (adjacent channel interference (ACLR), UEM, etc..) and EVM should be specified in a manner which does not require excessive measurement but offers the same performance and protection as the existing conducted requirements. TDD TX OFF power and other power dynamics requirements should also be readdressed.
    - In the UL an OTA reference sensitivity requirement is required to replace the conducted reference sensitivity. Once this has been established blocking, RX intermodulation and selectivity OTA requirements are needed.
2. Out of band requirements ~~(9kHz to 12.75GHz)~~ when the antenna element pattern is not known.
    - Interference to other systems is inherently a radiated effect. For a radiated requirement which offers the same level of protection as the existing conducted requirements, it will be necessary to decide if EIRP or TRP requirements are more relevant. Out of band requirements should be specified in a manner which does not require excessive measurement but offers the same co-existence and co-location protection as the existing conducted requirements.
    - There is a risk that the requirements will be over large frequency ranges and over many measurement directions (full sphere around the equipment). The requirement must be balanced between robustness and practicality.
3. EMC requirements, EMC radiated requirements are similar to the out of band radiated requirements, however both for EMC emissions immunity it must be considered how to handle the radiated wanted signal (the conducted wanted signal is currently put into a resistive load during EMC testing). There may be synergies identified between EMC testing and out of band spurious emissions and blocking testing.

It is possible that these 2 items could be separated but as the advantage in having a radiated requirement is to remove the connectorised interface there is little point in doing only one of the tasks. However different specification requirements may progress through the phases at different rates if beneficial to the WI progress.

Any new or modified requirements that are needed as a result of new or enhanced FD-MIMO functionality should be taken into account.

Phase I: Study phase: In this phase, a concept for how to define each requirements (including as necessary revised metrics) is established

Phase II: To specify appropriate requirements that are equivalent to the existing R13 AAS BS conducted requirements which are applicable over the air.

4.2 Objective of Performance part WI

NOTE: Leave empty if the WI proposal does not contain a RAN performance part.

As with the core part the performance work is split into 2 phases.

The same 2 major issues of the core work are the same for the conformance, with the addition of the performance (demodulation) requirements:

1. In-band requirements

   The existing AAS conformance specification already includes both DL and UL radiated requirement which measure the wanted signal AAS BS in specific directions. The conformance criteria for the other in-band requirements require study to understand the test coverage and number of spatial test points required to ensure compliance. Furthermore, measurement uncertainty and measurement path loss may need further evaluation for other requirements.

2. Out of band requirements

   Measuring out of band emissions requires test methodologies which have not yet been developed in the AAS BS work. Suitable methods, required test coverage, and test tolerances will require study.

3. Performance (Demodulation) requirements

   Performance requirements in Rel.13 are the same as the existing non-AAS performance requirements with some clarifications to the appropriate test method. Defined channels and fading profiles are simulated and applied to connectors at the conducted interface. WI should clarify which type of demodulation requirements can be applied as radiated requirements and how it might be tested. It is not within the scope of this WI to extend the scope of functionality captured by demodulation requirements.

As with the core part the performance work for each requirement may progress through the phases at different rates if beneficial to the WI progress

Phase 1: Study phase:

In this phase, a concept for how to test each requirement OTA is established.

Phase 2: Specify the test requirements.

The structure of the radiated test requirements for the existing AAS BS conformance requirement is such that multiple OTA measurement techniques and test tolerances can be used. Radiated requirements identify worst case or extreme spatial directions which are sufficient to test to show compliance to the core requirements.

Test requirements using such test methods shall be developed for the new radiated requirements.

4.3 RAN time budget proposal

NOTE: For WIs/SIs under RAN WG5 leadership this section is not filled out. Otherwise: For a not yet approved WI/SI the rapporteur has to fill out the last row of the table(s) below up to the target date of the WI/SI (if necessary add further tables): Indicate the number of time units (1 TU ~ 2h), i.e. one value for each session/field. If no time unit is needed, leave the field empty.
Once the WI/SI is approved, the tables below will no longer be updated in the WI/SI description (i.e. the tables reflect the status of the initial approval). But changes can be proposed in the status report of the WI/SI.

RAN #71										**Q2/2016**									**RAN #72**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf	R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
84bis	84bis	93bis	93bis	93bis	91bis	78bis	78bis	78bis	78bis	85	85	94	94	94	92	79	79	79	79
						1	~~**1**~~									**1**			

RAN #72 #73					**Q3/2016**				**RAN**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
86	86	95	95	95	93	80	80	80	80
						1.5		**0.5**	

RAN #73 #74										**Q4/2016**									**RAN**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf	R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
86bis	86bis	95bis	95bis	95bis	93bis	80bis	80bis	80bis	80bis	87	87	96	96	96	94	80	81	81	81
						1.5		**0.5**								**1.5**		**0.5**	**0.5**

RAN #74 #75					**Q1/2017**				**RAN**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
88	88	97	97	97	95	82	82	82	82
							1.5	**0.5**	**0.5**

RAN #75 #76										**Q2/2017**									**RAN**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf	R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
88bis	88bis	97bis	97bis	97bis	95bis	82bis	82bis	82bis	82bis	89	89	98	98	98	96	83	83	83	83
								1.5	**0.5**									**1.5**	**0.5**

RAN #76 #77					**Q3/2017**				**RAN**
R1L	R1U	R2L	R2U	R2J	R3	R4RF Core	R4RD Core	R4RF Perf	R4RD Perf
90	90	99	99	99	97	84	84	84	84
								1.5	**0.5**

L: LTE, U: UMTS, J: Joint, RD: RRM/demodulation

NOTE: In case further explanation of the time budget proposal is needed, then please explain this below.

additional comments to the time budget proposal:

5 Service Aspects

6 MMI-Aspects

7 Charging Aspects

8 Security Aspects

9 Impacts

Affects:	**UICC apps**	**ME**	**AN**	**CN**	**Others**

Yes			X		
No	X	X		X	X
Don't know					

10 Expected Output and Time scale

New specifications [If Study Item, one TR is anticipated]						
Spec No.	Title	1st rsp. WG	2nd rsp. WG(s)	Presented for information at plenary#	Approved at plenary #	Comments

NOTE: If this is a RAN WID including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Comments for each spec.
By default a new specs can only be new for one of both parts.

Affected existing specifications [None in the case of Study Items]				
Spec No.	CR	Subject of the CR	Approved at plenary#	Comments
37.105		AAS BS radiated core requirements	RAN #75 (Mar 2017)	Updated technical specification for AAS BS core requirements. Core part
37.842		AAS BS radiated core and conformance requirements	RAN #77 (Sep 2017)	Technical report for the RF background of AAS BS. Core part and Performance part
37.145		AAS BS radiated conformance requirements	RAN #77 Sep 2017)	Updated technical specification for AAS BS conformance testing Performance. part
37.114		AAS BS radiated EMC requirements	RAN #75 (Mar 2017)	Update technical specification for the AAS BS EMC requirements Core part

NOTE: If this is a RAN WID including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Comments for each spec.
If an existing spec is affected by both (Core part and Perf. part), then it has to be listed twice with appropriate approval dates.

11 Work item rapporteur(s)

Richard Kybett: richard.kybett @huawei.com

12 Work item leadership

RAN4: primary responsible WG

NOTE: If this is a RAN WID including Core and Perf. part, then this WG specifies the WG leading the Core part.
RAN WG4 is by default leading the Perf. part.

13 Supporting Individual Members

Supporting IM name
Huawei
Alcatel-Lucent
AT&T
CATT
CMCC
China Telecom
China Unicom
Ericsson
HiSilicon
NEC
Nokia Networks
NTT DOCOMO
Orange
Samsung
Sumitomo Electric Industries
Telus
ZTE